Dec. 18, 1962 G. OVERTON 3,068,585

DRIER MECHANISM AND METHOD

Filed March 26, 1959 2 Sheets-Sheet 1

Fig. 1

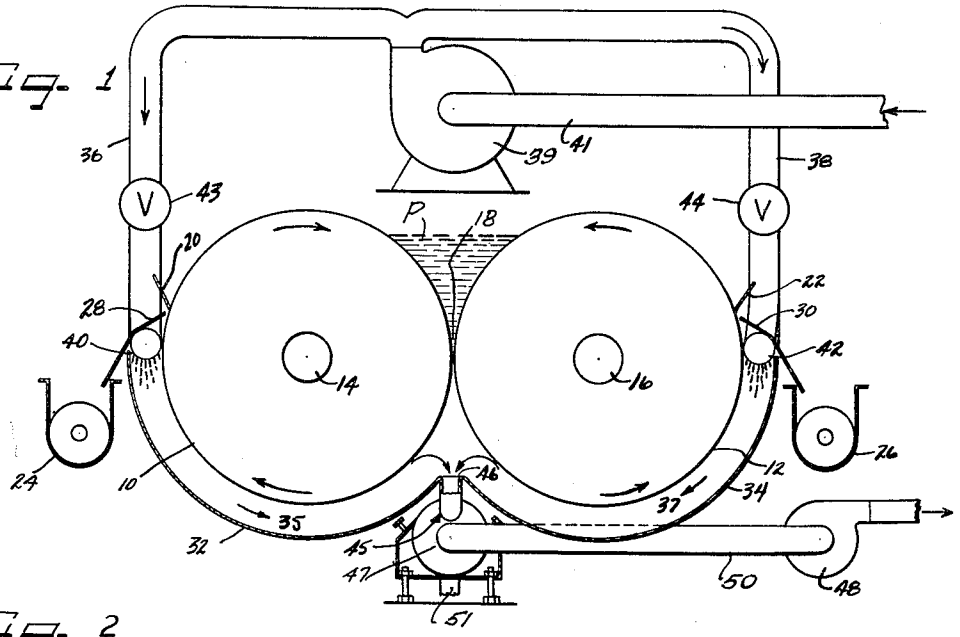
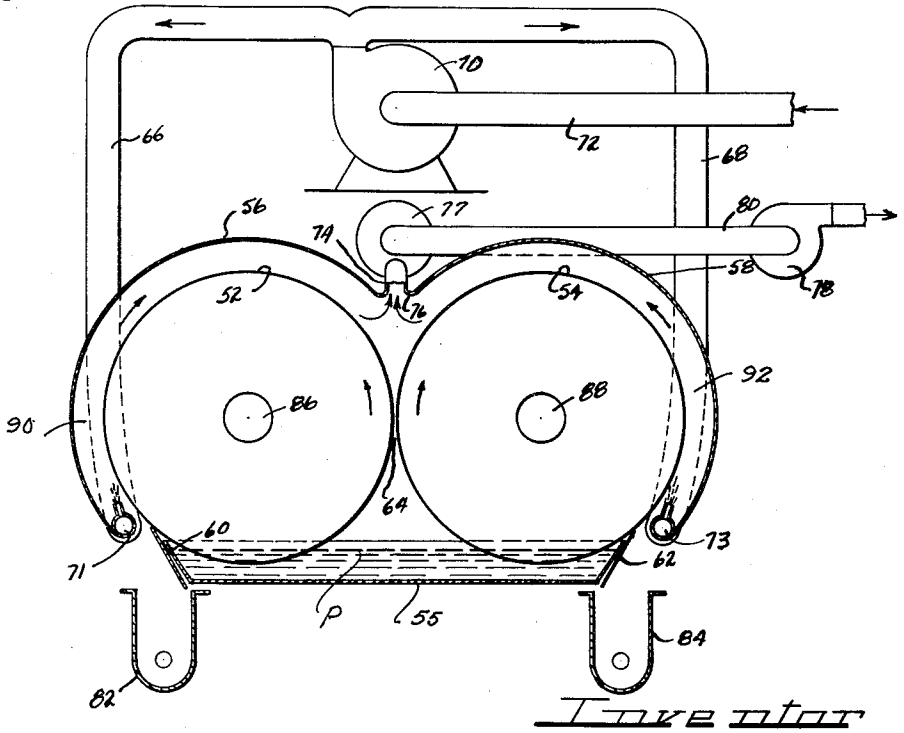


Fig. 2



Inventor
Glen Overton

by Hill, Sherman, Meroni, Gross & Simpson Attys

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DRIER MECHANISM AN. METHOD

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Fig. 3

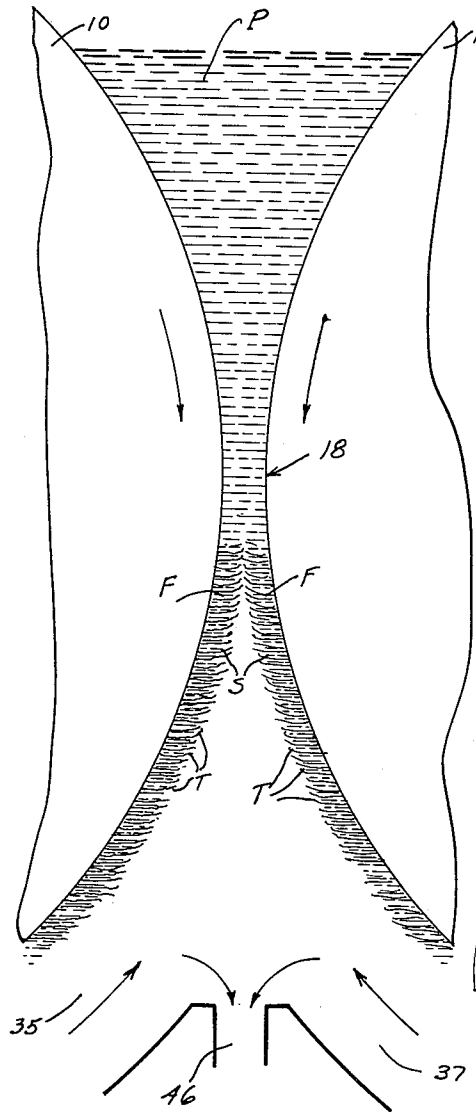
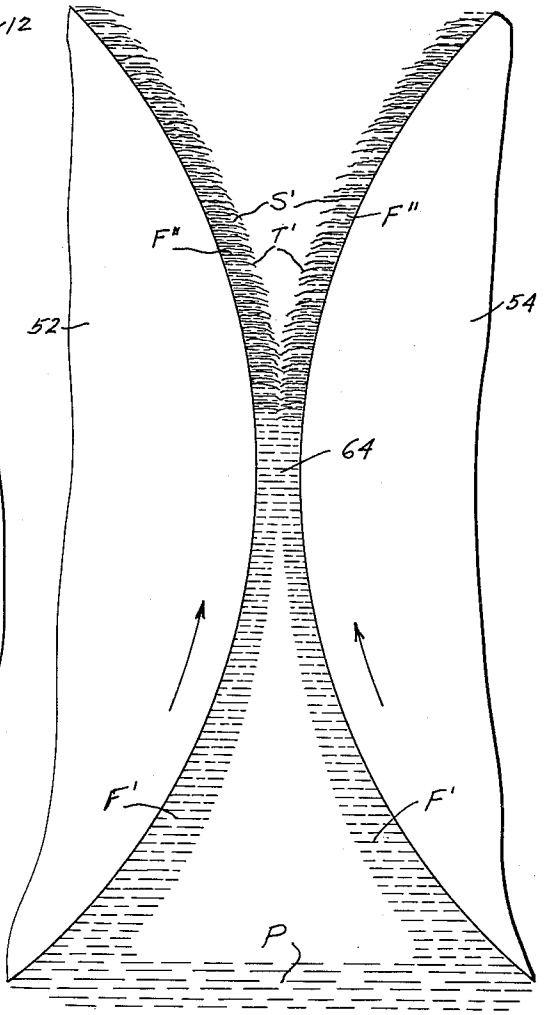


Fig. 4



Inventor
Glen Overton

by Hill, Sherman, Meroni, Gross & Simpson Attys.

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DRIER MECHANISM AND METHOD

Glen Overton, Allegan, Mich.

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6 Claims. (Cl. 34—17)

This invention relates to drum or roller driers and drying methods wherein uniform drying of heat sensitive materials deposited on the drums or rollers is obtained by projecting tendrils or flakes of the film of the materials into a heated gas stream surrounding the drums or rollers to dry the deposited film of material inwardly from both faces thereof without ever permitting the material to reach a temperature which will destroy any desired characteristics in the material. Specifically this invention relates to a method and an apparatus for drum drying fibrous and flaky materials which projects the flakes or fibers into a heated gas stream surrounding the drum dryer so that heat from the drum and heat from the gas stream will dry the material on the drum without overheating the material.

Heretofore drum or roller drying has included the formation of a film of material to be dried on the drum surface by means of heat applied through the drum surface. The film in some instances, was exposed to a gaseous drying atmosphere but the outer surface of the film was smooth and tightly adherent to the drum surface. In such arrangements most of the drying capacity was obtained by heat from the drum surface.

According to this invention films of material to be dried are formed on heated drum drier surfaces in such a way that the outer faces of the films are uneven and have flakes or tendrils projecting therefrom. A heated gas stream is flowed over the uneven outer face of the film in intimate drying contact therewith. The film is then dried inwardly from both faces including the radially outward drying from the drum surface and the radial inward drying from the exposed face. The temperature and drying capacity of the drum surface and the gas drying stream can be so controlled and regulated as to impart any desirable proportioning of drying effect on the film. For example, the drum surface may be maintained at a temperature just sufficient to cause a film of the material being dried to adhere thereon and most of the drying effect can be obtained from the gas stream or vice versa.

Fibrous or flaky materials to be dried according to this invention are formed into felt-like films or mats on the drums so that the tendrils or flakes project outwardly into the heated gas stream and 20% or more of the film can be in the form of these projected tendrils or flakes. Uniform drying of tendrils, fibers or flakes projecting from a fibrous or flaky film on the drum is easily achieved without burning the fibers or the underlying mat or without leaving a wet mat.

The method and apparatus of this invention are especially useful in the drying of fibrous or slaky slurries, such as citrus pulp obtained from the burring of oranges, grapefruits, lemons and the like, distillery slops, yeast slurries, milk and the like.

It is then an object of this invention to provide drum driers with hoods or shields coacting with the drums to define paths for drying gases to intimately contact films of material being dried on the drums.

Another object of this invention is to provide drum or roller drying apparatus which projects flakes or tendrils from films on the drums or rollers into heated gas streams and dries the films inwardly from the exposed faces thereof as well as outwardly from the faces thereof on the drums.

A still further object of this invention is to provide drum drying apparatus which forms films of material to be dried on the drum surface in such a way as to project flakes or tendrils from the films and which conveys the

exposed faces of the films through a drying gas stream.

Another object of this invention is to provide drum or roller drying equipment which circulates drying gas around the films on the drums in countercurrent flow relationship to the films.

Another object of the invention is to provide a method of drum or roller drying fibrous or flaky slurries by projecting fibers or flakes of the slurry from the film on the drum into a heated gas stream to be dried by contact with the stream.

A still further object of the invention is to provide a drum or roller drying method wherein films of material on the drum or roller are dried inwardly from their exposed faces as well as outwardly from the faces thereof that are deposited on the drum or roller.

Other and further objects of this invention will be apparent to those skilled in this art from the following detailed description of the next sheets of drawings which, by way of preferred examples only illustrate several embodiments of the invention.

On the drawings:

FIGURE 1 is a diagrammatic view of top feed type twin drum dried equipped with bottom hoods or guards and ducts for circulating drying gas over the films on the drums in accordance with this invention.

FIGURE 2 is a diagrammatic view of a bottom feed twin drum type dried equipped with top hoods or guards and ducts to flow drying gases over the films on the drums in accordance with this invention.

FIGURE 3 is a greatly enlarged fragmentary diagrammatic view showing the formation of the films on the drier of FIGURE 1 to project the tendrils or flakes into the gas streams.

FIGURE 4 is a view similar to FIGURE 3 but illustrating the film formation on the drums of the drier of FIGURE 2.

As shown on the drawings:

The top feed twin drum drier of FIGURE 1 includes a pair of drier drums 10 and 12 in side-by-side horizontal relation. These drums are rotatably mounted and include hollow trunnions 14 and 16 through which steam or other heating fluid can be supplied for heating the peripheral surfaces of the drums as desired. The drums are rotated in opposite directions as shown by the arrows to descend through a pond P of slurry or the like material to be dried. Suitable end dams (not shown) are provided to maintain the pond P in the entrance to the nip 18 between the downwardly descending quadrants of the drums.

The heated peripheries of the drums 10 and 12 pick up material from the pond P and convey it through the nip 18 whereupon the material is separated into two films which adhere to the surfaces of the separate drums and are carried on the drums to scrapers 20 and 22 which remove the dried films from the drum surfaces.

Troughs 24 and 26 are provided adjacent the drums 10 and 12 respectively to receive the dried films from aprons 28 and 30 coacting with the scrapers or doctors 20 and 22. The troughs 24 and 26 are preferably equipped with screw conveyors to move the dried material to one end of the apparatus.

Hoods or guards 32 and 34 are positioned around the lower halves of the drums 10 and 12 and are generally shaped to conform with the drum surfaces in uniform spaced relation therefrom. These hoods or guards 32 and 34 extend from immediately adjacent the doctors or scrapers 20 and 22 to provide flow spaces 35 and 37 around the film carrying portions of the drums. Conduits or ducts 36 and 38 supply heated air or other heating gas to the upper ends of the passages 35 and 37 through inlet openings 40 and 42 as shown. These inlets can extend along the whole lengths of the drums 10 and 12 to uniformly

feed the drying gas to the passages 35 and 37 against the films on the drums.

A blower 39 receiving heated air from a duct 41 supplies the heating air to the ducts 36 and 38 and dampers or control valves 43 and 44 in the ducts 36 and 38 control the heated air flow to the inlets 40 and 42.

An evacuating duct 45 has an inlet opening 46 beneath the nip 18 between the drums to receive the heated air from the flow paths 35 and 37. The inlet 46 to the evacuating duct 45 preferably extends the full length of the drums and can be in the form of an open slot or gap.

The exhaust duct or trough 45 discharges into a large diameter tube or dust separator 47. An exhaust fan or blower 48 is connected through a duct 50 with this tube 47 to remove the gas or air. An outlet 51 is provided in the tube 47 to remove the accumulated solids which are separated from the gas or air in the tube 47.

It will thus be apparent from the above description of FIGURE 1 that films emerging from the nip 18 adhere to the drums 10 and 12 and are carried thereby in countercurrent flow relation with the heated drying gases flowing through the flow paths or spaces 35 and 37.

As best shown in FIGURE 3 the slurry in the pond P discharges through the nip 18 between the drums 10 and 12 and this nip is gauged in width by adjustment of the drums toward and away from each other so that the films F adhering to the drum surfaces as they emerge from the nip will have very rough felt-like outer surfaces S with fiber tendrils or flakes T extending into the gas streams or paths 35 and 37. As it will be noted in FIGURE 3, the fibrous or flaky components of the slurry from the pond P are actually pulled outwardly from the film faces as these films are formed upon emerging from the nip 18. Thus, instead of flattening the outer faces of the films by pressure in the nip, the films are actually subjected to a radial outward pull for enhancing the roughness of their outer surfaces S and for encouraging the tendrils or flakes to stand up ight and project into good heat transfer relationship with the drying gas in the streams 35 and 37. In this manner the films F are dried on their faces which contact the drums 10 and 12 by radiation and conduction outwardly from the drum surfaces, while at the same time they are dried by intimate contact with the heating gases in the streams 35 and 37 through their exposed rough faces and tendrils or flakes. In effect, therefore, both opposite sides or faces of the films are dried.

In accordance with this invention the drying input of the streams 35 and 37 can be correlated as desired with the drying input of the surfaces of the drums 10 and 12 in any desired manner to obtain most of the drying from the drum surfaces or to obtain most of the drying from the gas streams. Of course, the drying capacities of the drums and gas streams could also be equally balanced if desired.

In the embodiment of FIGURE 2 the bottom feed twin drum drier includes a pair of drums 52 and 54 in side-by-side relation and rotated above a bottom pan 55 containing the pond P of the material to be dried. The drums dip into the pond P and are driven in the directions shown by the arrows to carry films of material from the pond on their peripheries. Top hoods or guards 56 and 58 encircle the drums 52 and 54 in spaced parallel relation therefrom and extend from doctors or scrapers 60 and 62 at the bottoms of the drums adjacent the pan 55. Heated drying gas is supplied through ducts 66 and 68 by a blower 70 from a supply duct 72 and is discharged through outlet tubes 71 and 73 adjacent the doctors. An exhaust duct 74 is provided at the tops of the hoods above the space between the drums. This duct provides an elongated outlet opening or gap 76 along the entire length of the space enclosed by the hoods. The outlet opening 76 discharges into a larger diameter tube 77 which may act as a dust separator. Gases are exhausted from the tube 77 by means of a blower 78 through a duct 80.

Troughs 82 and 84 are provided below the scrapers or doctors 60 and 62 to receive the dried films from the drums and these troughs can be equipped with screw type conveyors or the like for conveying the dried material to one end of the machine.

Suitable heating fluid trunnions 86 and 88 supply heating fluid to the interiors of the drums 52 and 54. As shown in FIGURE 4, the drums 52 and 54 upon ascending from the pond P have fluid films F' adhering thereto and partially draining back into the pond P. As the films F' approach the nip 64 between the drums their fluid outer faces are brought together so that the thickness of the two films is gauged to the width of the gap 64 which is actually determined by the spacing of the rollers or drums 52 and 54. As the drums continue to rotate, the merged films F' emerge from the nip 64 to form gauged films F'' with very rough felt-like outer faces S' composed of extended tendrils or flakes T'. In effect, the merged films are torn apart as the material passes out of the nip 64 and this tearing action has the very desired effect of projecting the tendrils or flakes outwardly from the outer faces of the films F''.

The films F'' are conveyed on the drums 52 and 54 through the flow paths 90 and 92 for the heating gas streams and the felt-like surfaces S' of these films are exposed to the heating gases in intimate contact with the gases. The gases and films travel in counterflow relation with the hottest and driest gases initially contacting the drier portions of the films and with the moisture laden gases at the top of the drums contacting the freshly deposited wet films.

As in the case of the embodiment of FIGURE 1, the machine of FIGURES 2 and 4 can be regulated so that any desired relationship of drying capacity can be applied to the drums and heating gases.

The machines and methods of this invention are especially useful in drying heat sensitive slurries without deleteriously affecting the solid materials in the slurries. For example, in the drying of organic pulps such as citrus pulp produced from the burring of oranges in orange juice plants, after the juice has been filtered, the residual pulp consists of the white part of the skin, the interstitial tissue between the orange sections, seeds and the like. This pulp has a high pectin content which is very heat sensitive. Films of such pulp formed on drum driers could not be adequately dried without overheating. The deliberate formation of rough felt-like faces on the films according to this invention and the drying of these faces with a heated drying gas has now made possible efficient rapid drying of such pulp without in any way adversely affecting the pectin content thereof. This applies also to grapefruit and other citrus pulps.

While twin drum driers have been illustrated as preferred embodiments of the invention, it should be understood that single drier drums could be used with means for extending the tendrils or flakes of the films deposited on the drums.

From the above description it will be understood that the driers of this invention have gas confining hoods or guards extending around the drier drums from the points where the dried films are removed to the points where the material to be dried is applied to the drums. The hot drying gases which may be composed of air or any desired drying fluid, flow in countercurrent relationship to the direction of travel of the films on the drums. The driers of this invention make possible a thorough dehydration of materials without overheating or underheating and permit processing of materials at a much higher rate than heretofore possible. The hoods or guards confine the heat so as to reduce heat radiation losses and

the moving gas streams under the hoods provide for efficient removal of moisture without effecting the atmosphere outside of the hoods.

It will be understood by those skilled in this art that the herein disclosed specific principles and details can be widely varied without departing from the spirit and scope of this invention as set forth in the hereinafter appended claims.

I claim as my invention:

1. The method of drying a fibrous organic pulp which comprises rotating a pair of heated drier drums in side-by-side relation through a pond of said fibrous organic pulp causing film of the pulp to adhere to each drum, contacting the outer faces of the films on each drum in pressure-free relationship so said outer faces are not flattened, separating the films after said contact, extending the outer faces of the films during said separation to project fibrous tendrils from the films, flowing heated drying gas over the extended outer faces of the films on the drums, simultaneously drying the films with the drying gases and the heated drums, and thereafter separating the dried films from the drums.

2. The method of drying fibrous and flaky slurries on a twin drum drier which comprises rotating a pair of side-by-side heated drum driers downwardly through a pond of the slurry therebetween, picking up films of the slurry on each drum from said pond, contacting the outer faces of the films on each drum in pressure-free relationship so as not to flatten said outer faces, separating said contacted outer faces and simultaneously pulling flakes and fibers outwardly from the faces to provide felt-like roughened surfaces on the films, counter flowing heated drying gas streams over the roughened surfaces of the films on the drier drums, removing moisture laden gases from the vicinity of the drying drums, and scraping dried films from the drums before the drums re-enter the pond of slurry.

3. A bottom feed twin drum drier comprising a pair of cylindrical drums positioned for counter-rotation through a slurry feed pan at the bottom thereof and defining a predetermined spaced nip therebetween, a doctor for each of the drums, a guard casing for each of the drums extending in overlying closely spaced relationship thereto to define a flow space approximately from the doctor therefore to the area of the nip, a duct formed in register with the nip coacting with said guard casing to define an outlet from said flow spaces disposed above the nip, and a conduit for each of the drums to introduce a heated gas into the space defined by the guard casing and the drum in immediate approximate relationship to the doctor for said drum.

4. A bottom feed twin drum drier which comprises a pair of drier drums positioned for counter-rotation through a slurry feed pan at the bottom thereof and said drums in side-by-side relation defining a nip therebetween sized for bringing together the outer surfaces of slurry films in pressure-free relationship so as not to flatten said outer surfaces on the drums but to roughen said outer surfaces, a scraper for each drum remote from said nip for removing dried films from the drums, a hood in overlying relationship embracing the drums approximately from the scrapers to the nip areas thereof defining a flow space, and means for flowing streams of drying gas under the hood in said flow space to engage the roughened films on the drums.

5. The method of drying on a bottom feed twin drum drier which comprises dipping a pair of adjacent drum driers into a pond of slurry, counter-rotating the drums to carry films of slurry upwardly from the pond, contacting the outer faces of the films on each drum so as not to flatten said outer faces, pulling the contacted faces apart while simultaneously extending tendrils of slurry material from said surfaces to increase the surface area of the films, flowing heated drying gases over the extended surfaces of the films on each drum, removing moisture laden gases from the vicinity of the drums, and scraping dried films from the drums.

6. The method drying fibrous and flaky slurries on a bottom feed twin drum drier which comprises dipping a pair of adjacent drum driers into a pond of the slurry, counter-rotating the drums to carry films of the slurry upwardly from the pond, contacting the outer faces of the films on each drum in pressure-free relationship so as not to flatten said outer faces, pulling the contacted faces apart while simultaneously extending tendrils of slurry material from said surfaces to increase the surface areas of the films, flowing heated drying gases over the extended surfaces of the films on each drum, removing moisture laden gases from the vicinity of the drums, and scraping dried films from the drums.

References Cited in the file of this patent

UNITED STATES PATENTS

924,271	Paucksch	June 8, 1909
1,014,609	Roeh	Jan. 9, 1912
1,037,545	Savy	Sept. 3, 1912
1,530,439	Testrup	Mar. 17, 1925
2,158,354	Cowgill	May 16, 1939
2,502,935	Fetzer	Apr. 4, 1950
2,770,294	Fischer	Nov. 13, 1956

FOREIGN PATENTS

16,682	Austria	June 25, 1904